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Newport, RI

# STRATEGIC AIRLIFT: DOING MORE WITH LESS

by

Michael D. Retallick

Major, USAF



A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: Michael D. Retallick

25 January, 1995

Paper directed by

Cdr G. A. Marsh
&
Cdr St. C. Armitage

**ABSTRACT of**

Strategic Airlift: Doing More With Less

This paper focuses on the United States military strategic airlift system and its capability to employ combat forces worldwide. As history has shown, many wars have been won or lost as a result of, or lack of, logistics. The key to success is to rapidly deploy and concentrate combat power in the area of operations. This requires a tremendous amount of strategic resources to project such power. Power projection, in airlift terms, is measured in "Million Ton Miles per Day". It is a mathematical calculation based on several variables such as payload, utilization rate and airspeed. If the United States Transportation Command is to meet worldwide threats in a timely manner, then is imperative the Joint Force Commander maximizes strategic airlift efficiency with emphasis on operational planning. Airlift shortfalls must be offset by 1) an early identification of theater requirements and an effective plan of action, 2) improving operational plans by pre-planning unit mobilization requirements. This will enable the United States Transportation Command to accomplish the mission in an efficient manner.

## BACKGROUND

Strategic airlift is a system composed of many parts. These components or parts of an airlift system need to be scrutinized if the whole is to be utilized to its maximum capacity. This report focuses on fighting a Major Regional Conflict (MRC) utilizing all military strategic airlift platforms, C-5, C-141 and the KC-10, to their maximum capacity according to the 1995 Air Mobility Master Plan (AMMP). These three aircraft platforms reflect the fiscal year 1995 estimated capability to airlift 30 Million Ton Miles per Day (MTM/D).[1]

MTM/D is the method used by Air Mobility Command (AMC) to quantify requirements and assess capabilities in evaluating its force structure to United States Transportation Command (USTRANSCOM). However, MTM/D ignores the wide range of potential contingencies and the requirement associated with timing (flow control), system interactions, infrastructure constraints and the difference between bulk, oversize and outsize cargo. The MTM/D is an estimated capability. Therefore, a Joint Task Force Commander (JTFC) needs to minimize the effects of limitations and constraints imposed by the airlift system and how this can affect operational plans.

A JTFC has to exercise a great deal of flexibility, communication and coordination with USTRANSCOM in directing airlift forces to meet a theater's requirement. Balancing

requirements with forces yet to be deployed from the United States, resupply needs, and the ever changing priorities in military operations places a great deal of emphasis on an efficient smooth operating airlift system. This paper addresses two factors which inhibits USTRANSCOM's ability to efficiently meet a JTFC's requirement.

## AIM

Past conflicts have yielded valuable lessons in **Operational Planning** and vital information on **Physical Constraints.** These above two areas will be analyzed from articles written on strategic airlift operations and from the author's experience in C-141 contingencies and humanitarian relief efforts such as Panama (Just Cause), Somalia (Provide Hope) and Operation Desert Shield/Storm (ODS).

A JTFC must analyze each potential threat or conflict to judiciously allocate limited mobility assets to meet time critical combat requirements. It is no surprise that inefficient strategic airlift operations can produce less than optimal results from allocated resources. Too often, AMC starts sending aircraft to pick some unit up - before determining what really needs to be done. This paper will identify several choke points and corrective actions applicable to the current airlift force structure.

## DISCUSSION

People often think of strategic airlift as a resource to be allocated. Yet airlift is a system consisting of many components that must work together for the whole to function properly. Careful planning is required to have aircraft deliver what is needed, where it is needed, when it is needed and with as little idle time as possible. A considerable amount of time is needed to prepare the cargo prior to an aircraft arriving at the onload base. Aircraft have to be unloaded, loaded, or both, and that must be accomplished by trained personnel with specialized equipment. Aircraft must be serviced and maintained which requires adequate supplies and support equipment on site. Finally, aircrews must be available in sufficient numbers and prepared for each mission.

### Operational Planning

A JTFC's operational plan (OPLAN) *should* have an extremely detailed database called a Time Phase Force Deployment Data (TPFDD) with accurate and validated transportation information. The TPFDD enables combat units to set forth sequencing and timing with airlift resources. Such an operation requires extensive planning. For example, during the early stages of ODS, some Army planners calculated each C-141 could carry 65,000 pounds when in actuality it could only carry a maximum of 40,000 pounds.[2]

This is an excellent example of how range affects the maximum allowable cabin load.

In addition, ODS began without a formal plan or TPFDD and as a result the Joint Operations Planning Execution System (JOPES) could not keep up with the changes. Constantly changing requirements and priorities for deployment complicated airlift planning. Without a TPFDD for deployment, units used whatever data they had. Many reserve units that were deployed in late 1990 had little or no mobility experience. Often databases were inaccurate and outdated. Equipment phased out years earlier still appeared on the equipment listing, while some newer pieces did not.[3]

The absence of a detailed plan equates to inefficient utilization of airlift resources. MTM/D is based on the assumption that everything will perform optimally (similar to no stop and go traffic on a four lane interstate highway during rush hour). For example, operations were hampered by large surges and stops created by the lack of a daily requirement plan. Large troop movements resulted in airfields becoming saturated one day and empty the next. The first units to deploy during ODS, such as the 82nd Airborne were experienced, trained and equipped for rapid deployment. Unlike the VII Corps, which was organized to receive deploying units and was not trained to deploy itself, especially to a desert.

Inadequate planning resulted with insufficient combat forces in theater. It took about 130 extra C-141 loads and 1 extra ship to move elements of the XVIII Corps to Saudi Arabia.[4] Although this figure is not exact, it illustrates one important point - the "pucker factor". When units deploy for training exercises, they know they won't die from insufficient food, water, ammo, (etc.). However, when deploying to a real combat environment, units will pack extra food, water, ammunition and whatever else is necessary for a unit's survival. Planning factors and real requirements need to be determined to realistically meet airlift (or sealift) resources.

Planning assumptions can be overly optimistic when thinking in terms of planned MTM/D. MTM/D is calculated using the following variables:[5]

$$\frac{\text{(Utilization Rate) x (Blockspeed) x (Payload) x (.47 - Productivity Factor)}}{\text{1,000,000 Nautical Miles}}$$

Productivity Factor - aircraft fly empty back from the theater

Utilization (UTE) rates can be unrealistic as will be explained later in the aircraft performance section. The following table illustrates the FY 95 MTM/D planning assumptions for each strategic airlift platform.[6]

| | UTE RATE (Surge/Sustained) | BlOCKSPEED (kts) | PAYLOAD (Short-tons) | PRODUCTIVITY FACTOR | MTM/D Per Aircraft |
|---|---|---|---|---|---|
| C-5 | 10.87/8.39 | 423 | 65 | 0.47 | 0.14 |
| C-141 | 12.1/9.7 | 410 | 23 | 0.47 | 0.054 |
| KC-10 | 12.5/10.0 | 445 | 40 | 0.47 | 0.105 |

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|---|---|
| UTE Rate: | is the flying time in a specific period expressed in hours per aircraft per day. One calculates UTE rate by aggregating the hours flown by all aircraft and dividing by all aircraft, whether or not they flew during that period. Thus, one counts non-mission capable aircraft and mission capable aircraft not flown. |
| Surge: | first 45 days (i.e. maximize aircraft utilization) |
| Sustained: | allows maintenance to catch up with repairs (indefinite time) |

During ODS, the average C-141 payload was 19 short tons. Compared to the planned payload of 25.6 short tons, this was a shortfall of 26 percent (the average C-5 payload during ODS approximated its expected estimate, but experienced enormous maintenance problems).[7] The C-141 payload during ODS was still far short of the planned FY 1995 payload of 23 short tons. There were several explanations associated with these airlift short falls; however, three extremely important points can be concluded. First, C-141s were limited to 20 short tons by the Military Airlift Command (MAC) in August, 1990, due to the inner-outer wing joint structural problem (nobody had told the Army of this restriction). Secondly, lighter than anticipated payloads resulted from inadequate planning time, thereby filling up the available space before grossing out the aircraft ("cube out" versus "gross out"). Thirdly, and related to the second, the Army's requirement for airlift per division is growing faster than our growth in airlift capability. The Army's M1 tank, Bradley Infantry Fighting Vehicle, and HUMMV are vastly superior to the equipment they replaced, but they are also much heavier and bulkier.[8]

During the past decade, the Army has paid little attention to airlift capabilities when designing and procuring new equipment. The percentage of outsized equipment in the Army inventory has significantly increased and the Army has been designing and building equipment based on the specifications of the C-17 cargo compartment.[9] Here are two examples of how equipment modifications have affected airlift planning factors: First, the addition of two inches to the width of new jeeps meant they could no longer be carried two abreast in the C-141, thus doubling the lift requirement.[10] Once the C-141 could deliver 17 jeeps in a single load, now it can only carry 5 High-Mobility Multipurpose Wheeled Vehicle (HUMMVs - the new jeep of the 1980s/90s) before it becomes "cubed out". Secondly, the airlift of the Bradley fighting vehicle in the C-141 requires 6 hours to disassemble/load and 6 hours to offload/reassemble.[11] The Bradley fighting vehicle has replaced systems that could have been loaded three or four strong in a C-141. The C-141 can carry one Bradley fighting vehicle with a pallet of disassembled parts. This means it takes longer to load and unload a Bradley than it takes the C-141 to fly from Fort Hood, Texas, to Frankfurt, Germany.[12] This is far from the concept of roll-on/roll-off and the ability to deliver (or extract) combat forces in a timely matter.

Weapon systems modernization and force structure changes are resulting in more **outsize** systems ineligible for C-141 transport. This requires the C-5 platform to deliver these weapon systems. In summary, Army forces are heavier - requiring more airlift missions. Here are some newer Army systems that can further reduce airlift capabilities at the expected AMC rates and payloads during time critical contingencies:[13]

1. **Multiple Launch Rocket System (MLRS).** It can be transported on a C-141 without missiles and with system reduction.

2. **Patriot Missile System** - replacing Hawk (transportable by C-130 & C-141). C-141 transport requires extensive preparation.

3. **AH-64 & UH-60 Helicopters** - replacing AH-1 & UH-1 (transportable by C-130 & C-141). Both require extensive preparation for C-141 transport and fewer helicopters can be transported.

4. **Armored Gun System** - replaces M551 Sheridan tank. Requires removal of armor to protection level 1 for C-141 & C-130 transport.

5. **Command and Control Vehicle** - replaces M113 mounted command posts. Exceeds C-130 and C-141 parameters.

6. **Advanced Field Artillery System** - replaces M109A6 howitzer. Exceeds C-141 transport parameters.

7. **Line of Sight Antitank** - replacing improved TOW Vehicle (C-130 and C-141 transportable). LOSAT exceeds C-130 and C-141 restrictions.

8. **Bradley Fire Support Vehicle** - replacing the Fire Support Team vehicle. Not practical for C-141 transport, requires extensive preparation and support equipment.

Army combat units have seen a steady increase in the growth during the last ten years. The following three Army division types eligible for air deployment have seen weight growth between 36 and 55 percent.[14]

Light Infantry Division - 11K tons (1987) to 15K tons (1993)

Airborne Division - 16K tons (1983) to 22K tons (1993)

Air Assault Division - 22K tons (1983) to 34K tons (1993)

These figures do not include resupply or logistics to sustain any type of combat operations.

**Enroute Bases.** Aircraft enroute bases should not be chosen arbitrarily, they should offer: refueling systems, maintenance, crew facilities and have adequate ramp space/runway to handle the airlift flow between the continental United States and the theater.

Aerial Ports of Embarkation/Debarkation (APOE/APOD) can severely impact airlift operations. For example, Point Salinas, the main airfield in Grenada (Urgent Fury), had a parking ramp large enough to accommodate only one C-130. Due to no ramp space, C-141s had to be off-loaded on the runway. Airlift operations commenced once the Point Salinas airfield was secured. However, there was a huge backup in the air because of the absence of ramp space to offload cargo. Many aircraft spent more time in holding overhead the airfield than they did in transit.

Commanders remarked aircraft were stacked up to the "ionosphere" and some aircraft had to divert to Puerto Rico to refuel.[15]

Organizational problems surfaced during the Grenada operation. A Military Airlift Command (MAC) liaison assigned to the Task Force Commander handled all requests for supplies and access to the island by air. There was a lack of joint planing and coordination at the JTF level. Units located in Grenada and the United States overstepped the liaison's authority which resulted in a conflicting airlift system with no effective command and control.

**Material Handling Equipment.** Grenada reinforced the lesson learned from Vietnam that highly mobile, quick insertion operations require specialized equipment and combat trained and equipped personnel. More important, Grenada emphasized the importance of utilizing the appropriate type of Material Handling Equipment (MHE) and deploying with spare parts such as tires and hoses.[16] Functional MHE and available parts are crucial in an environment with very limited ramp space for off-load operations. Planning for the Panama invasion incorporated lessons learned from the Grenada invasion. The correct type of aerial port force packages were tasked to support the operation.

An airlift system is only as efficient as its MHE. The Achilles heel of the airlift program is the lack of specialized MHE for loading and unloading the large aircraft available today;

MHE at both ends of the air bridge is the key to rapid, efficient operations.[17] Old MHE (40 ton K-loader) proved to be unreliable and frequently caused delays or limited throughput during Desert Shield/Storm. MHE during ODS used was 1960's technology and prone to breakdown. In the Saudi climate, seals and gaskets were also a problem.[18] *(It is interesting to point out that pallets caused delays as well. Aircraft were off-loading pallets faster than they could be delivered to the user causing congestion on the airfield. Just the same, there was a shortage in pallets at the APOE because it was easier to load pallets onto trucks at the APOD rather than breaking them down by hand, thus, the pallets were transported 300 miles away in the desert - taking months to return.)*

The aging MHE fleet (40 ton K-loader) is in its second overhaul cycle and is eight years past its contract life expectancy. In addition, the 40 ton K-loader is expensive to maintain and has a 10 hour mean time between failure rate.[19] The modernization of the 40 ton K-loader and the purchase of the new 60 ton K-loader should be a high priority for mobility forces.

**Physical Constraints**

C-5 and C-141 aircraft performance during ODS was far below expected performance levels. The C-5 in particular was plagued by logistical delays (supply, maintenance, servicing, airframe, etc.) more so than the C-141. ODS UTE rates were a third to a half below planned levels: 5.7 hours for the C-5 and 7 hours for the C-141.[20]

One could look at the low UTE rates during ODS in two ways: either aircraft were not needed to meet airlift requirements or it is the combination of the problems mentioned in this paper. Nevertheless, it is the author's belief that airlift planners will not plan for airlift movements which they can not fulfill. In other words, not only do capabilities change to meet requirements, but when capabilities decline over time, planners adjust their expectations and reduce requirements. Therefore, it is hard to imagine the *real airlift requirement* when thinking in this manner.

However, let's expand upon why capabilities decline over time in the eyes of an airlift planner. The C-5 and C-141 aircraft are old and require more logistical attention (maintenance, parts, etc.) to operate during surge operations. If aircraft are to meet increased flying demands (especially the C-5 and C-141), they will require more spare parts to keep them operating. Spare parts for peacetime and spare parts for wartime are two separate reserves. These war reserves are important to sustain home station departures as well as worldwide airlift commitments. A Government Accounting Office report (in 1990) alleged the Air Force was using its war reserve parts to support peacetime operations.[21]

In the process of maintaining a balance in strategic airlift capability, the Air Force (in 1990) was using its war reserve

spares. Thus, given this shortage of war reserve spares, it is unlikely that the C-5 and the C-141 could sustain the planned surge rates of 11 and 12.5 hours per day, respectively, for a 30 day period required during wartime.[22] As a matter of fact, ODS somewhat proved this point. The average percentage at any one time of aircraft not available due to logistical constraints was 32.3 percent for the C-5 and 16.8 percent for the C-141 from August 1990 through March 1991.[23]

More recently, airlift operations in Somalia, Rwanda, Haiti and in Kuwait have hard pressed AMC's strategic airlift assets. The constant high use of the fleet during the last three years for contingency and humanitarian support have put a lot of stress on the spare parts systems. Gen. Merrill A. Mcpeak, then the Air Force Chief of Staff, quotes: "This impact can be clearly seen in the usage rates of spare parts." In addition, Gen. Mcpeak noted the declining fill rates for the C-141 and C-5 readiness spares packages. "AMC's ability to sustain the airlift fleet is compounded by the age of the fleet".[24]

There have been numerous other cases after ODS illustrating logistical problems. According to the Air Force Times on 19 December, 1994 (P.22): "As of Dec. 7, 25 percent of the transport fleet was being overhauled, and many of the rest were being repaired at their respective bases. Twenty-five of 126 C-5s were being overhauled, as were 60 of 242 C-141s." How can the Air

Force effectively employ its strategic airlift fleet to meet expected performance levels when it is constantly being repaired?

In summary, here are some C-141 logistical constraints since ODS which have significantly impacted (25 percent or more aircraft) AMC's strategic airlift capability:

1. **Aug. 1990** - Aircraft restricted to 74% of the design structural capability of the inner to outer wing joint.

2. **May 1992** - Aircraft pressurization restrictions due to windshield post area cracks.

3. **Sept 1993** - Wing weep hole problems grounds affected C-141 aircraft.

4. **Jan 1994** - Engine malfunctions caused by improper maintenance in wing area weep hole repairs grounds affected aircraft.

5. **1994 year** - One-fourth of AMC's C-141 fleet was grounded this year for stress fractures in the wing area.[25]

6. **Dec 1994** - All C-141 aircraft are unrestricted. Normal operations.

## CONCLUSION

This paper identified several choke points or bottlenecks in **Operational Planning** and **Physical Constraints**. It is the author's conclusion that AMC's strategic airlift platforms (C-141, C-5 and KC-10) are not capable to meet its wartime requirement of 30 MTM/D. In practice, MTM/D is the product of a number of variables such as: cargo volume and weight, aircraft speed, utilization rate, maintenance and ground time requirements for loading and unloading.

The Army's force structure has created a heavier, bulkier fighting force. Unfortunately, AMC's airlift capability has not kept up with this changing force structure. As United States combat forces continue to face ever more modern tanks, missiles and guns around the world, they have become heavier and bulkier to deploy. This problem is further complicated by the withdrawal of forward deployed bases around the world.

In summary, inaccurate planning assumptions coupled with physical constraints can lead the JTFC to be overly optimistic in AMC's ability to meet strategic airlift requirements. Aircraft performance of the aging and overtaxed C-141 and C-5 aircraft demonstrated problems in the recent deployment of Army forces to Somalia.[26]

> "It took ten days to deploy a battalion Task Force from Ft. Drum, NY to Somalia .... scrambled by a series of technical difficulties that forced Air Force transports to put down in airfields from New Jersey to Greece. Besides maintenance problems, the availability of only two airfields capable of handling C-141s into the objective area severely hampered the flow into the country".

## RECOMMENDATION

Contingency planning requires the corporate knowledge of an airlift expert. However, an expert can only bring the planning tools and data systems necessary to support the joint planning

process. Planning factors must be reexamined and better explained to users and deploying units to develop and update mobility plans. The JTFC needs to accurately identify requirements early enough for USTRANSCOM to best determine the way to accomplish the mission.

Every unit should have current and updated transportation feasibility plans for TPFDD requirements. Previous contingencies have shown that "AD HOC" crisis action plans suffer from inadequate planning resulting with inefficient utilization of airlift resources. In order for JOPES to work, a TPFDD needs to be established. Otherwise, airlift resources will be inefficient in supporting the JTFC's operational plan. Although easier said than done, the TPFDD planning process needs to be refined. USTRANSCOM should develop an airlift planning school to further study shortfalls, bottlenecks and check points to the users.

Deploying military units must keep up with the latest procedures and changes for deployment. After all, units have a large responsibility to be ready when the aircraft arrives. The United States military has experienced enormous organizational changes and with the large turnover in personnel, military units have many other things to worry about besides deployment. Expecting the Air Force (or USTRANSCOM) to be the experts in how to best deploy is not the answer.

Mobilization or airlift has never been studied in detail, nor has it been completely understood. Its effects are not clearly seen and not easily discernible. Airlifters must learn from past operations and apply these lessons to future contingencies. If the United States is to do more with less, then we must focus attention toward mobilization.

Ultimately, the question seems to be can the United States get there in time? Presently, the answer to this question depends upon the response. It appears the United States will not change its combat power to a lighter fighting force, nor will it admit an inability to answer a crisis. Only a commitment to the future can change the answer to a heavily qualified "YES".

## ENDNOTES


1. Department of the Air Force, Air Mobility Command (AMC/XP), Air Mobility Master Plan [AMMP] (Scott AFB, IL, 1995), p. 9.

2. Telephone Conversation with Colonel David J. Semon, Administrative Assistant - Secretary of the Air Force, (SAF/AA), Pentagon, Washington, DC, 10 Jan 95.

3. Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993, p 20.

4. Telephone Conversation with Colonel David J. Semon, Administrative Assistant - Secretary of the Air Force, (SAF/AA), Pentagon, Washington, DC, 10 Jan 95.

5. Department of the Air Force, Air Mobility Command (AMC/XP), Air Mobility Master Plan [AMMP], (Scott AFB, IL, 1995), p. 9.

6. Ibid, p. 11.

7. Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993, p 22.

8. Price, William J., Strategic Mobility: Can We Get There In Time, U.S. Army War College, Carlisle Barracks, PA, 1990, p. 27.

9. U.S. Department of Defense, Defense 94. (Issue 6), Balanced Surface, Sealift, Airlift, Alexandria, VA, p. 35.

10. Eichhorst, Thomas E., Military Airlift: Turbulence, Evolution, and Promise for the Future. Air University, Maxwell AFB, AL, 1991, p. 32.

11. Telephone conversation with Capt Robert D. Thomas, Airlift planner, Headquarters Air Mobility Command, HQ AMC/XPPF, Scott Air Force Base, IL, 15 Jan 1995.

12. U.S. Department of Defense, Defense 94. (Issue 6), Balanced Surface, Sealift, Airlift, Alexandria, VA. p. 42.

13. Department of the Air Force, Air Mobility Command (AMC/XP), Air Mobility Master Plan [AMMP] (Scott AFB, IL, 1995), p. 21.

14. Ibid, p. 45.

15. Harrington, John D., United States Strategic Doctrine and the Evolution of Military Airlift, 1987, (Defense Technical Information Center), University of Pennsylvania, PA, p. 45.

16. Parker, David J., Aerial Ports in Low Intensity Conflict: Vietnam, Grenada, and Panama, 1990, (Defense Technical Information Center). Air Force Institute of Technology, Wright-Patterson Air Force Base, OH, pp. 72-74.

17. Price, William J., Strategic Mobility: Can We Get There In Time, U.S. Army War College, Carlisle Barracks, PA, 1990, p. 32.

18. Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993, p. 43.

19. U.S. Department of Defense, Defense 94. (Issue 6), Balanced Surface, Sealift, Airlift, Alexandria, VA, p. 35.

20. Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993, p. 35.

21. U. S. Government Accounting Office, Military Airlift, (report #NSIAD-90-186), Report to the Secretary of Defense (Washington: 1990), p. 18.

22. Ibid, p. 22.

23. Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993, p. 60.

24. Kitfield, James, "Airlift at High Tempo," Air Force Magazine, Jan, 1995, p. 58.

25. Ibid, p. 61.

26. Drummond, Raymond R, Airlift: The Strategic Achilles Heel of The United States, U.S. Army War College, Carlisle Barracks, PA, 1993, P. 8.

## BIBLIOGRAPHY


Department of the Air Force, Air Mobility Command (AMC/XP), Air Mobility Master Plan [AMMP] (Scott AFB, IL, 1995).

Drummond, Raymond R, Airlift: The Strategic Achilles Heel of The United States, U.S. Army War College, Carlisle Barracks, PA, 1993.

Eichhorst, Thomas E., Military Airlift: Turbulence, Evolution, and Promise for the Future. Air University, Maxwell AFB, AL, 1991.

Harrington, John D., United States Strategic Doctrine and the Evolution of Military Airlift, 1987, (Defense Technical Information Center), University of Pennsylvania, Philadelphia, PA.

Kitfield, James, "Airlift at High Tempo," Air Force Magazine, Jan, 1995.

Parker, David J., Aerial Ports in Low Intensity Conflict: Vietnam, Grenada, and Panama, 1990, (Defense Technical Information Center). Air Force Institute of Technology, Wright-Patterson Air Force Base, OH.

Price, William J., Strategic Mobility: Can We Get There In Time, U.S. Army War College, Carlisle Barracks, PA, 1990.

Rand Corporation, An Assessment of Strategic Airlift Operational Efficiency, (Report # R-4269/4-AF), Santa Monica, CA, 1993.

Telephone Conversation with Colonel David J. Semon, Administrative Assistant - Secretary of the Air Force, (SAF/AA), Pentagon, Washington, DC, 10 Jan 95.

Telephone conversation with Capt Robert D. Thomas, Airlift planner, Headquarters Air Mobility Command, HQ AMC/XPPF, Scott Air Force Base, IL, 15 Jan 1995.

U.S. Department of Defense, Defense 94. (Issue 6), Balanced Surface, Sealift, Airlift, Alexandria, VA.

U. S. Government Accounting Office, Military Airlift, (report #NSIAD-90-186), Report to the Secretary of Defense, Washington: 1990.